REFERENCE 34

91-05154/

PRELIMINARY REVIEW OF
NEW BRUNSWICK'S MINERAL INDUSTRY
1989

Edited by

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NEW BRUNSWICK

February, 1990

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PRELIMINARY REVIEW OF NEW BRUNSWICK'S MINERAL INDUSTRY 1989

EXPLORATION

Base metals and gold dominated mineral exploration in New Brunswick in 1989. Good prices for zinc, lead, and copper sustained interest in the Bathurst camp (Figure 1) where several large deposits of these metals have been found over the past 38 years. As pointed out several times, these deposits, characterized by shallow depths, were relatively easy to find. The challenge for current explorationists in this region is to find similar but blind (deep-seated) deposits. Since these deposits are below the depth that exploration technology can penetrate, the search will be guided by detailed geological mapping, such as that carried out during the 1984-89 Canada - New Brunswick Mineral Development Agreement. The benefits of this detailed work are already apparent. In November of 1989, **Brunswick Mining and Smelting Corporation Limited** announced the discovery of massive sulphides 2 km north of its No. 12 mine (Figure 2, 1). A drill hole put down to test a prediction based on detailed geology intersected 8.5 m of sulphides grading 9.91% zinc, 4.61% lead, 0.22% copper, 183.4 g/t silver, and 1.65 g/t gold, at a depth of approximately 1100 m. The discovery is directly linked to predictions made by C.R. van Staal of the Geological Survey of Canada who recently completed detailed structural mapping in the area.

Other highlights of the year include the opening of the Heath Steele-Stratmat and Caribou base metal mines, and the Murray Brook gold mine (Figure 2, 2-4).

Gold exploration continued to be strong and, again, was most intense in northern New Brunswick in the Millstream-Alcida, Riley Brook, and Jacquet River-Upsalquitch areas as well as along the eastern end of the Rocky Brook-Millstream Fault (Figure 1, Alcida-Upsalquitch River gold belt). In southern New Brunswick, the search continued in the Bay of Fundy gold belt, and the Annidale-Nerepis belt (Figure 1).

Northern New Brunswick

Base metals were the focus of exploration activity in northern New Brunswick during 1989, largely in the Bathurst camp (Figure 1). More than a dozen companies were active and an estimated $11 000 000 was spent.

Noranda Exploration Company Limited spent $7 500 000, most of it in the Heath Steele-Stratmat and Halfmile Lake (Figure 2, 5) areas. Since June, 1989, four drill rigs have been working continuously on the Stratmat property to delineate the eastern extension of the orebody, and two drills are currently working at Heath Steele. In February, Noranda and Brunswick announced that the Heath Steele mill would re-open to process ore from the Stratmat deposit. Exploration on at least ten surrounding properties included geological mapping, geochemical and geophysical surveys, and trenching. Drilling programmes were also completed on five other properties outside the Heath Steele-Stratmat and Halfmile Lake areas.

Falconbridge Limited, taken

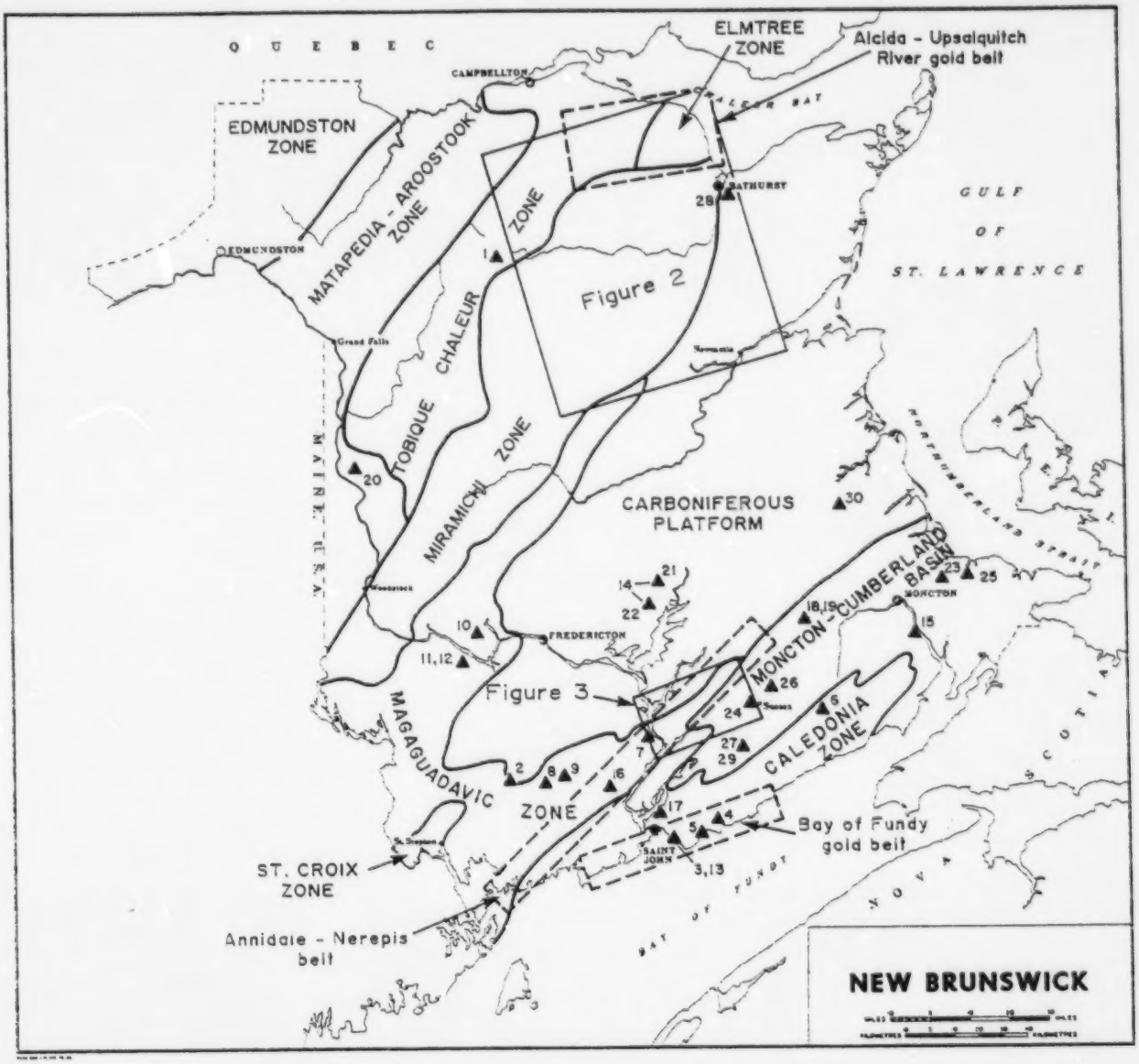

Figure 1. Properties explored or mined in 1989. Tectonostratigraphic zones and mineralized belts are indicated by heavy solid and dashed lines, respectively.

1. Claims, Mount Carleton property (Placer Dome Inc.)
2. Mount Pleasant mine (LAC Minerals Limited and Billiton Metals Canada Ltd.) tin, tungsten
3. Claims, Cape Spencer-Balls Lake (Mispec Resources Inc.)
4. Claims, Marigold property (Neptune Resources Corp.)
5. Claims, Black River property (Maritime Resource Research Ltd.)

6. Claims, Mechanic Settlement (Corona Corporation)
7. Claims, Evandale property (Costigan Gold Corporation)
8. Claims, Jimmy Hill prospect (Goldfluor Exploration Limited)
9. Claims, Sand Brook Mountain (Grand Empire Exploration Limited)
10. Claims, Scotch Lake grid (Brunswick Mining and Smelting Corporation Limited)
11. Claims, Waterloo Lake grid (Brunswick Mining and Smelting Corporation Limited)
12. Lake George mine (Dominion Explorers Inc.) antimony
13. Cape Spencer deposit (Gordex Minerals Limited) gold
14. Minto-Chipman area (N.B. Coal Limited) coal
15. Stoney Creek (Irving Oil Limited) natural gas
16. Blagdon (Brunswick Ready-Mix Concrete Ltd.) granular aggregate
17. Brookville (Brookville Manufacturing Company Ltd.) limestone
18. Havelock area (Lafarge Canada Inc.) limestone
19. Havelock (Havelock Lime) limestone
20. White Mud Lake (Upper Kent Lime Works Ltd.) marl
21. Chipman (L.E. Shaw Limited) brick shale
22. Minto (Avon Aggregates Ltd.) shale
23. Shediac (Smith Cut Stone and Quarries Ltd.) dimension stone
24. Sussex (Nelson Monuments Ltd.) dimension stone
25. Shediac (Dupuis Cut Stone Ltd.) dimension stone
26. Sussex area (Potash Company of America) potash
27. Salt Springs (Denison-Potacan Potash Company) potash
28. Bass River (Chaleur Silica Limited) silica
29. Cassidy Lake (Sussex Silica Limited) silica
30. Beersville (N.B. Power) coal

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over in 1989 by Noranda Exploration Company Limited and Trelleborg AB (Sweden), staked approximately 1300 claims during the first quarter of the year in the Nash Creek-Jacquet River area (Figure 2, 6), north of the Bathurst camp in the Siluro-Devonian volcanic belt. An airborne Dighem survey was flown over the claim block in the spring. Additional claims were optioned from prospectors during the summer. Preliminary exploration was conducted over much of the ground and a drilling programme (7000 m) was completed in the vicinity of the Nash Creek base metal occurrences that are adjacent to the north-trending Jacquet River Fault.

Brunswick Mining and Smelting Corporation Limited, as a result of an overburden drilling programme, discovered an interesting stibnite showing in a fault zone that cross-cuts interbedded Tetagouche mafic volcanics and black slates (Figure 2, 7). Four trenches on the Caribou Road property intersected stibnite mineralization; the best assays were 5.1% antimony over 1.1 m and 5.6% antimony over 0.4 m. However, 11 drill holes showed that the mineralized zone is subeconomic, although assays up to 13.6% antimony over 0.3 m were obtained.

Acadia Mineral Ventures Ltd. staked more than 1000 claims in the Bathurst camp during the first quarter of 1989 (Figure 2, 8). Subsequently, Acadia acquired control of **Guinness Gold Resources Limited** and transferred a large number of

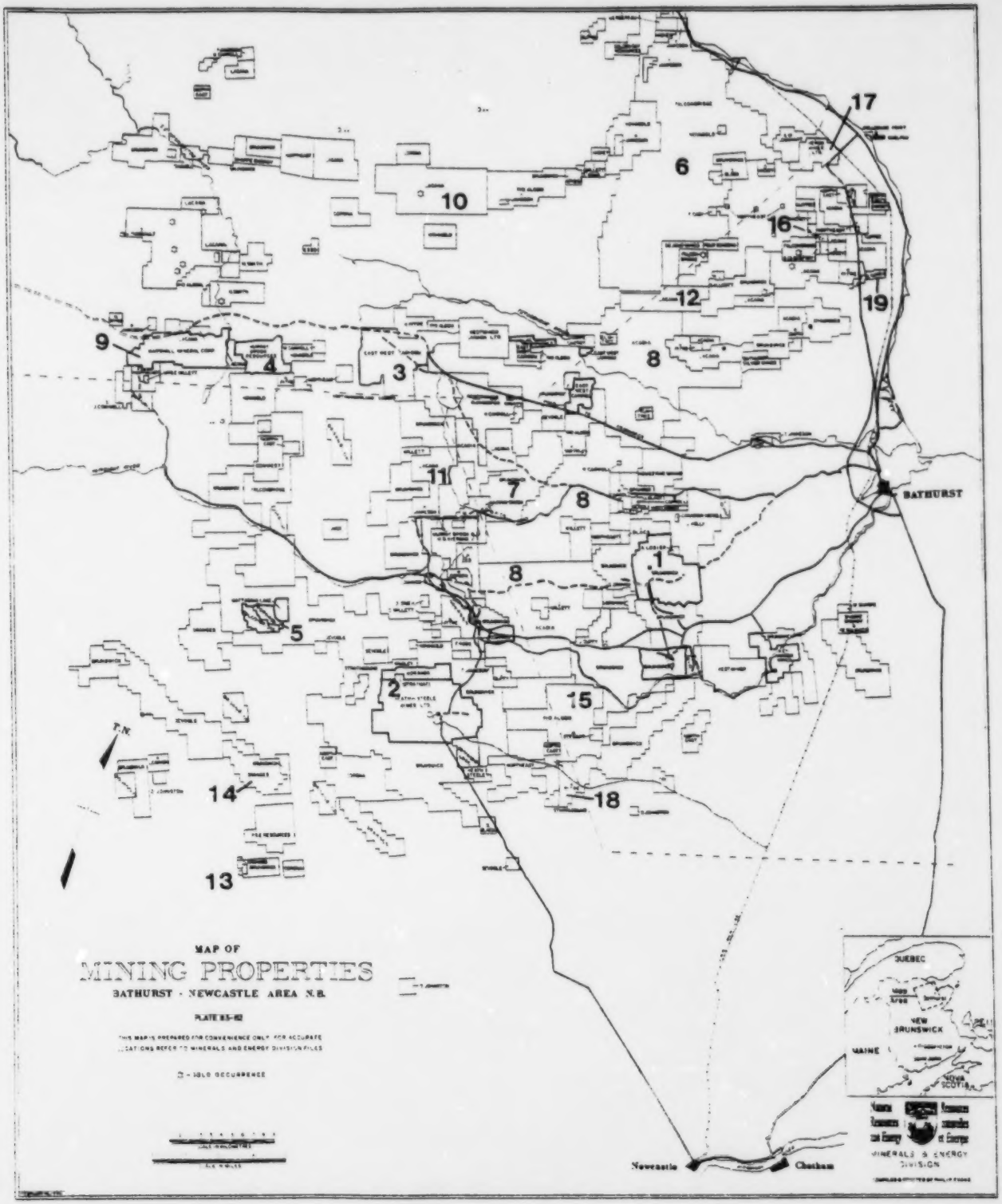

Figure 2. Claims in the Bathurst camp and Alcida-Upsalquitch River belt of northern New Brunswick (February, 1990).

1. Brunswick No. 12 mine (Brunswick Mining and Smelting Corporation Limited) zinc, lead
2. Heath Steele-Stratmat deposit (Heath Steele Mines) zinc, lead, silver, copper

3. Caribou mine (East West Caribou Mining Limited) zinc, lead
4. Murray Brook deposit (Murray Brook Resources Inc.) base metals, gold, silver
5. Claims, Halfmile Lake area (Noranda Exploration Company Limited)
6. Claims, Nash Creek-Jacquet River area (Falconbridge Limited)
7. Claims, Caribou Road area (Brunswick Mining and Smelting Corporation Limited)
8. Claims, Nepisiguit-Tetagouche rivers area (Acadia Mineral Ventures Ltd.)
9. Restigouche deposit (Marshall Minerals Corp.) zinc, lead, silver
10. Claims, Rocky Brook area (Lacana Mining Corporation Limited/ Corona Corporation)
11. Claims, California Lake area (Lacana Mining Corporation Limited/ Corona Corporation)
12. Claims, Elmtree (Alcida) gold deposit (Lacana Mining Corporation Limited/ Corona Corporation)
13. Claims, Clearwater area (Granges Exploration Ltd.)
14. Claims, Maliseet Mountain Cu-Ni area (Granges Exploration Ltd.)
15. Claims, Nepisiguit Brook area (Rio Algom Exploration Inc.)
16. Claims, Madran area (Aurtec Incorporated)
17. Turgeon deposit (Heron Mines Limited) zinc, copper
18. Captain North Extension (N. Pitre/Stratabound Minerals Corp.) massive sulphides
19. Elmtree deposit (Elmtree Resources Ltd.) limestone

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these claims to Guinness Gold. Others were transferred to **Westminer Canada Limited.** Both companies started preliminary exploration programmes on their claims at the beginning of July. Recently, Acadia sold its interest in Guinness Gold to a management group headed by Mr. William Burton of Atlantic Goldfields Inc.

Marshall Minerals Corp., who has made application to mine the Restigouche zinc-lead-silver deposit (Figure 2, 9), has conducted trenching and diamond drilling on other company claims near the deposit.

Corona Corporation excavated additional trenches on its Rocky Brook precious metal property (Figure 2, 10) in the Siluro-Devonian volcanic belt. As a result, northwesterly trending mineralized structures have been found that were not tested during the initial drilling. Currently, Corona is completing trenches in a new zone at its California Lake silver property (Figure 2, 11) and on soil anomalies east of its Elmtree (Alcida) gold deposit (Figure 2, 12).

Several other companies were also active. **Granges Exploration Ltd.** drilled four holes on its Clearwater property (Figure 2, 13) and ten holes on its Maliseet Mountain Cu-Ni property (Figure 2, 14). **Rio Algom Exploration Inc.** conducted geological mapping and geophysical surveys on its Nepisiguit Brook property (Figure 2, 15), located immediately north of the CNE deposit. **Aurtec Incorporated** trenched and drilled near Madran, north of the Bathurst camp (Figure 2, 16). **Heron Mines Limited** offered its Turgeon copper deposit (Figure 2, 17) near Belledune to a number of potential joint-venture partners. **Placer Dome Inc.**

carried out preliminary exploration on its claim group north of Mount Carleton Park (Figure 1, 1) in the Siluro-Devonian volcanic belt.

Southern New Brunswick

Mineral exploration in southern New Brunswick continued to be dominated by the search for gold and platinum-group elements. Improved market conditions for tin have also renewed exploration interest for that element.

NovaGold Resources Inc. announced recently that it had reached an agreement in principle to option the Mount Pleasant base-metal property (Figure 1, 2), currently held by LAC Minerals Limited and Billiton Metals Canada Ltd. The option, for a 12-month period that may be extended by an additional three months, is exercisable at any time for $12 000 000. The option price is subject to adjustment based on the current price of tin. NovaGold also agreed to pay LAC's and Billiton's maintenance costs, $20 000 per month, during the option period. NovaGold will carry out a feasibility study to evaluate the economic viability of the property.

A deposit that contains 5 000 000 t of ore, averaging 0.79% tin, had been delineated by underground exploration and drilling. NovaGold is proceeding with an exploration programme to increase ore reserves, and with metallurgical testing to improve metal recovery. Diamond drilling began in late 1989.

Gold exploration continued in the Hercynian thrust zone along the southern margin of the Avalon tectonostratigraphic terrane (Bay of Fundy gold belt, Figure 1) southeast and southwest of Saint John. The gold deposits are associated with major thrust faults that superimposed Precambrian volcanic and intrusive rocks on Paleozoic sedimentary rocks. Free gold and gold in pyrite occur in intensely mylonitized zones that are accompanied by extensive illite and carbonate alteration.

Mispec Resources Inc. continued to explore its large claim group in the Cape Spencer-Balls Lake area (Figure 1, 3) southeast of Saint John. This property covers the northeastern extension of the gold-bearing zone on the property of **Gordex Minerals Limited.** Mispec announced encouraging results from its Birches Zone. One drill hole intersected 4.01 g/t gold over 4.0 m, which included one section of 9.46 g/t gold over 1.0 m. Another hole yielded 3.43 g/t gold over 9.0 m, which included 5.31 g/t gold over 4.0 m, 14.89 g/t gold over 1.0 m, and 13.47 g/t gold over 1.0 m. Previous drilling in the Road Zone, which constitutes the immediate extension of the Gordex ore zone, intersected 8.50 g/t gold over 5.5 m. Late in 1989, Mispec signed a $1 890 000 agreement with Hecla Mining Company of Canada Ltd. to explore the Cape Spencer-Millican Lake properties.

Several other companies continued exploration in the Bay of Fundy gold belt northeast of the Mispec Resources property. **Neptune Resources Corp.** conducted VLF EM, magnetic, and geochemical surveys and some diamond drilling on its Marigold property, 20 km northeast of Cape Spencer (Figure 1, 4). In a previous survey on this property, Rex Silver Mines Ltd. obtained anomalous gold values from soil samples (27-274 ppb Au) and a gold-bearing grab sample assaying 4 413 ppb Au. One hole drilled by Neptune Resources intersected about 17 g/t Au over 1 m. **Maritime Resource**

Research Ltd. mapped the geology of its Black River property (Figure 1, 5) and conducted stream and till geochemical sampling programmes. One stream sediment sample assayed 1800 ppb Au.

Farther northeast along the Bay of Fundy coast, **Corona Corporation** continued to explore its platinum-palladium prospect at Mechanic Settlement (Figure 1, 6), which is associated with a Precambrian mafic-ultramafic intrusive complex. The company also explored for gold in the Pollett River area, northwest of Alma.

The notable increase in gold exploration in the northeastern part of the St. Croix tectonostratigraphic terrane, which started near the abandoned settlement of Annidale in 1988, was extended 80 km to the southwest across the Saint John River and into the South Oromocto Lake area. Gold occurrences are associated with prominent fault zones that bound and occur within the St. Croix Terrane.

Northeast of the Saint John River, **Inco Gold Company** conducted a programme comprising induced polarization, soil geochemistry, trenching, and diamond drilling on the former LAC Minerals property, about 1.5 km south of Annidale (Figure 3, 1). One hole drilled across an I.P. anomaly previously delineated by LAC Minerals intersected 3.12 g/t Au over 1.52 m. Other companies conducting geophysical and geochemical surveys, trenching, and diamond drilling in the St. Croix Terrane, northeast of the Saint John River, include **BP Resources Canada Limited, Brunswick Mining and Smelting Corporation Limited, Corona Corporation, PGE Resource Corp., and Maritime Resource Research Ltd.** (Figure 3).

Several companies also explored southwest of the Saint John River in the St. Croix Terrane. **Costigan Gold Corporation** conducted magnetic, VLF-EM and gravity surveys on its copper-gold-bearing zone in the northwestern part of the Middle Devonian Evandale granodiorite stock, immediately west of the Saint John River (Figure 1, 7). **Goldfluor Exploration Limited** trenched and sampled its Jimmy Hill gold prospect (Figure 1, 8), which occurs in metasedimentary rocks near Middle Devonian granodiorites, northeast of South Oromocto Lake. Grab sample assays range from 1000 ppb to 20.1 ppb Au. Brunswick Mining and Smelting Corporation Limited is also exploring a claim group in the Jimmy Hill area, but results of this work were not released at the time of writing this report. **Grand Empire Exploration Limited** discovered two new gold- and arsenopyrite-bearing quartz veins on its Sand Brook Mountain claim group, southwest of West Mill Settlement (Figure 1, 9). A similar vein was found recently northeast of Sand Brook Mountain by prospector William Carter. A grab sample from that vein assayed 6000 ppb Au.

Brunswick Mining and Smelting Corporation Limited explored claim groups in the Scotch Lake area northeast of the Lake George antimony mine, and in the Lower Prince William area southeast of the Pokiok Batholith (Figure 1, 10,11). Numerous gold-scheelite occurrences were found in previous years in the southeastern contact aureole of the Pokiok Batholith. The most prominent of these occurrences was delineated in the Lake George antimony mine, where 7.5 g/t Au was bound over 2.1 m of drill core and an 82 cm chip sample in a drift assayed 18.5 g/t Au.

In 1986, **Eastern Gypsum Inc.**

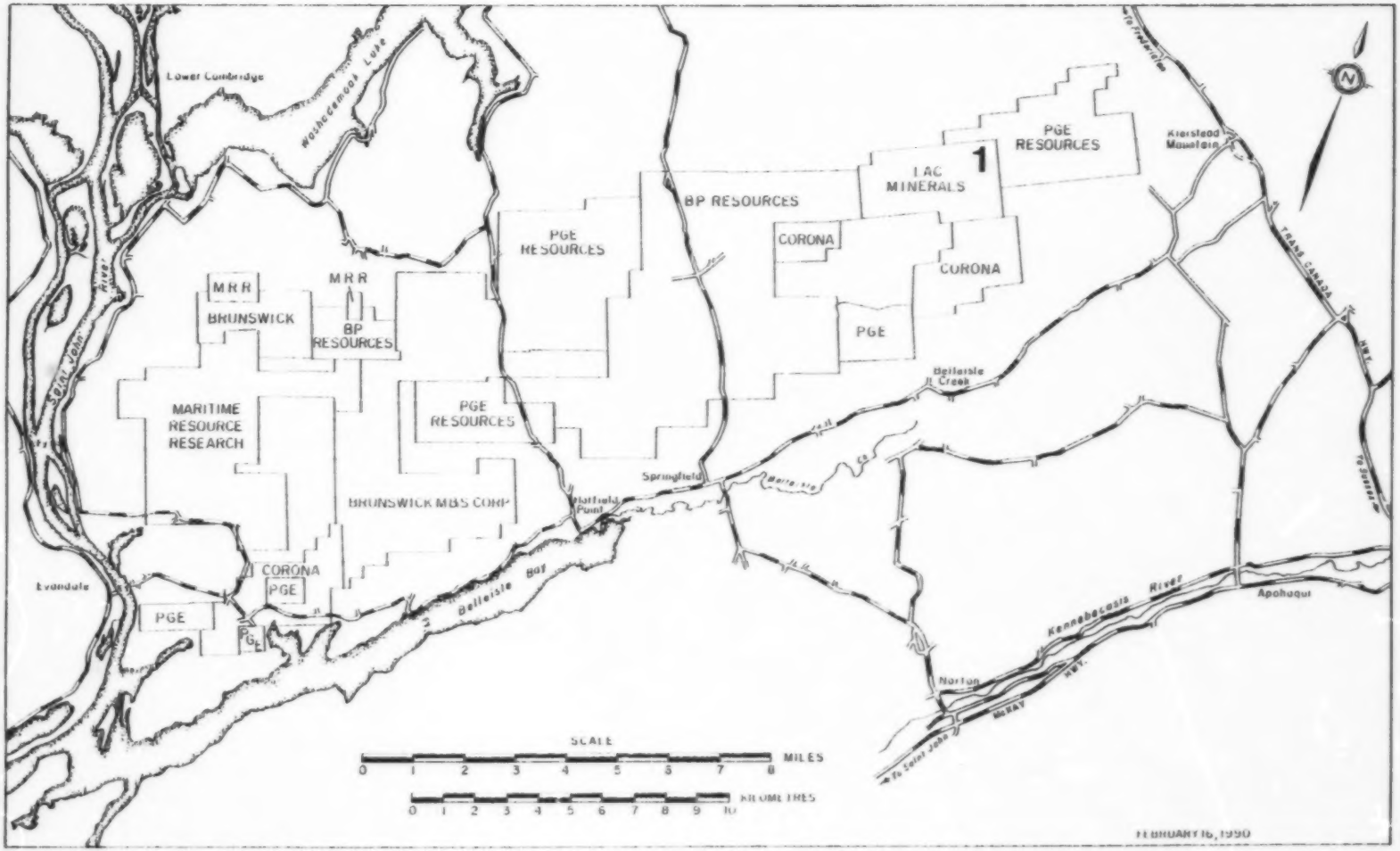

Figure 3. Claims in the Annidale-Nerepis area of southern New Brunswick (February, 1990).

1. Annidale property (LAC Minerals Limited)

announced its intention to establish a wallboard manufacturing facility at McAdam in York County. It would serve northeastern United States markets. The company evaluated gypsum deposits in Albert County and near Sussex as potential sources of supply. The plant at McAdam is scheduled to open in the late summer of 1990.

N.B. Power acquired Provincial Holdings' interest in the Beersville coal deposit (Figure 1, 30) in 1989 and was negotiating with St. Lawrence Cement for its interest in the property. In 1989, N.B. Power undertook a drilling programme and in 1990 will expose the coal seam using a dragline. The work is necessary to prove seam thickness and continuity, to determine pit floor conditions and acid-water generation potential, and to obtain a bulk sample for test burns. The company has registered the project under Department of Environment's Environmental Impact Assessment (EIA) Regulation. Information collected from the diamond-drilling programme will indicate whether the seam can be mined in an environmentally acceptable manner and whether the project will require a full EIA review.

Mineral Lands

The total number of claims staked in 1989 was 8736, up 26% from the 1988 total of 6936 (Figure 4, Table 1). At the end of the year, there were 21 334 claims, 6 coal agreements (5789 claim equivalents), 2 other agreements (226 claim equivalents), 3 potash leases (2382 claim equivalents), and 15 mining leases (927 claim equivalents) in effect, which represent a total claim equivalent of 30 658 (up 15% from 1988). Exploration expenditures reported in assessment reports submitted in 1989 was $9 290 145 (Table 1).

Amendments to the Mining Act and Regulations were proclaimed into effect December 6, 1989.

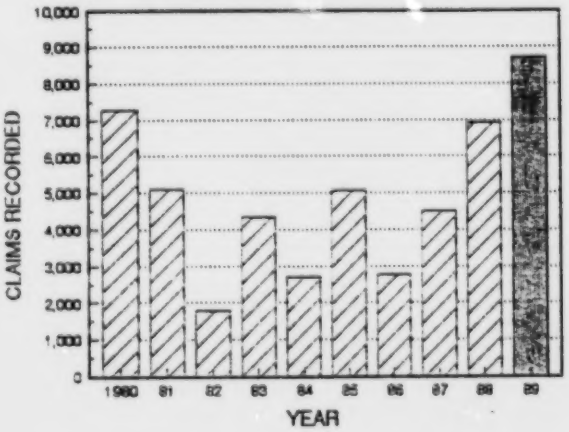

Figure 4. Mineral claims recorded, 1980 to 1989.

DEPOSITS BEING DEVELOPED

Marshall Minerals Corp.

The Restigouche deposit (Figure 2, 9) is situated on Charlotte Brook, which drains into Upsalquitch Lake.

After acquiring the mineral rights to the Restigouche deposit in March of 1988, Marshall Minerals embarked on an extensive drilling programme to define reserves and processibility of the ore. Results proved favourable and in February, 1989, Marshall Minerals registered a proposal to operate an open pit mine in compliance with the Environmental Impact Assessment (EIA) Regulation. A full assessment was required because Upsalquitch

TABLE 1. MINERAL LANDS AND EXPLORATION STATISTICS, 1989

MINERAL LANDS (total in effect at year's end unless specified for 1989)	No.	Claim Equivalent	Hectares	% Inc. Over Prev. Year* (Decrease)
Prospecting Licences	733	-	-	13
Claims Recorded, 1989	8 736	-	139 776	26
Claims Renewed, 1989	12 598	-	201 568	53
Claims Expired, 1989	2 863	-	45 808	56
Claims in Effect	21 334	-	341 344	34
Coal Agreements	6	5 789	92 624	N/A
Other Agreements	2	226	3 616	-
Potash Leases	3	2 382	38 108	0
Other Leases	15	927	14 832	33
Total Claims and Claim Equivalents	-	30 658	490 524	15
Oil-Gas Licences	2	-	66 072	0
Oil-Gas Leases	4	-	13 289	0
Bituminous Shale Licences	-	-	-	-
Bituminous Shale Development Permits	-	-	-	-
Bituminous Shale Leases	1	-	1 439	0
Underground Storage Licences	-	-	-	-
Underground Storage Leases	-	-	-	-
Quarry Permits	366	-	-	0
Quarry Leases	7	-	481.27	0
Peat Licences (issued 1989)	0	-	-	-
Peat Licences	4	-	1 767	50.5
Peat Leases	27	-	10 841	2.5

EXPLORATION	Number	Length (m)	Value ($)
Assessment Reports	200		9 290 145
Drilling	334 holes	62 048	3 669 926
Potash Exploration Expenditure			-
Drilling	-	-	-
Oil-Gas Exploration Expenditure			-
Drilling	-	-	-
Bituminous Shale Expenditure			-

* Based on number of hectares, where applicable.

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Lake is well known for its sport fishing in a relatively undisturbed part of the Province. The company is currently compiling its EIA report for the project and hopes to receive a positive response early in 1990.

Because the deposit is not large enough to support a mill, the company has entered into an agreement with East West Caribou Mining Limited to process the Restigouche ore. This agreement is contingent upon the results of a bulk sample test that will be processed at the Caribou site. The bulk sample will be extracted when the EIA has been approved.

The cost of bringing the property into production is expected to be approximately $3 000 000, bringing Marshall's total costs up to $5 000 000. Production is anticipated to average 750 t/d from an open pit operation employing 25 people for a period of 8 years.

Stratabound Minerals Corp.

In December, 1987, Stratabound optioned the Captain North Extension (CNE) deposit (Figure 2, 18) from Norman Pitre.

During 1988-89, a road was constructed to the site, and the area for the open pit was cleared, partly excavated, and tested by shallow drilling in preparation for the bulk sampling. The excavation revealed geologic structures and stratigraphic relationships that prompted further drilling to find the deposit's southern extension. Drilling and trenching indicated a high grade, low tonnage, zinc-lead-copper-silver deposit 6 m below surface.

Initial bench-scale metallurgical tests indicated high recoveries and acceptable grade concentrates. Based on these results, Stratabound registered the project under the Environmental Impact Assessment (EIA) Regulation; subsequent screening resulted in conditional approval of the company's proposal.

Stratbound then applied to the Department of Natural Resources and Energy to remove a 12 000 t bulk sample to test the metallurgy of the ore in a local mill. Removal of the bulk sample is tentatively scheduled for the first quarter of 1990. Because of the relatively low tonnage, the company plans to custom mill the ore, and anticipates a production rate of approximately 500 t/d from an open pit mine. A production decision is expected upon completion of the bulk test.

OPERATING MINES, WELLS AND QUARRIES

Production Statistics

The preliminary estimate of the value of New Brunswick's mineral production for 1989 is $909,547,000 (Table 2 and Figure 5). This represents a marginal decline from the 1988 final value of $910 803 000. The main reason for this apparent lack of growth was a significant reduction in production offset by higher metal prices.

The value of metals produced, $639 524 000, comprises 70% of total mineral production. Zinc, which made the most notable improvement, rose in value to $485 621 000. It represents 53% of the total value of production. Higher zinc prices ($0.90 to $0.60/lb. US) were offset

TABLE 2. MINERAL PRODUCTION IN NEW BRUNSWICK, 1989
(Compiled from Energy, Mines and Resources statistics)

Preliminary Estimate

METALS	Units	Quantity	Value ($)
Antimony	kg	---	5 526 000
Bismuth	kg	155 000	2 286 000
Cadmium	kg	41 000	666 000
Copper	kg	8 264 000	28 259 000
Gold	g	341 000	4 952 000
Lead	kg	68 356 000	71 227 000
Silver	kg	197 000	40 987 000
Zinc	kg	224 616 000	485 621 000
TOTAL			639 524 000
NONMETALS			
Gypsum	t	---	---
Peat	t	217 000	21 630 000
Potash	t	---	---
Silica	t	---	---
Salt	t	---	---
Sulphur (in smelter gas)	t	85 000	12 844 000
TOTAL			194 218 000
FUELS			
Coal	t	525 000	33 800 000
Natural Gas	m^3	---	---
Petroleum Crude	m^3	---	---
TOTAL			33 800 000
STRUCTURAL MATERIALS			
Clay products		---	2 565 000
Cement		---	---
Lime		---	---
Sand and Gravel	t	9 039 000	15 228 000
Stone	t	2 250 000	13 614 000
TOTAL			42 005 000
GRAND TOTAL 1989 CDN $			$909 547 000
GRAND TOTAL 1988 CDN $			$910 803 000
GRAND TOTAL 1987 CDN $			$622 231 000

February 15, 1990

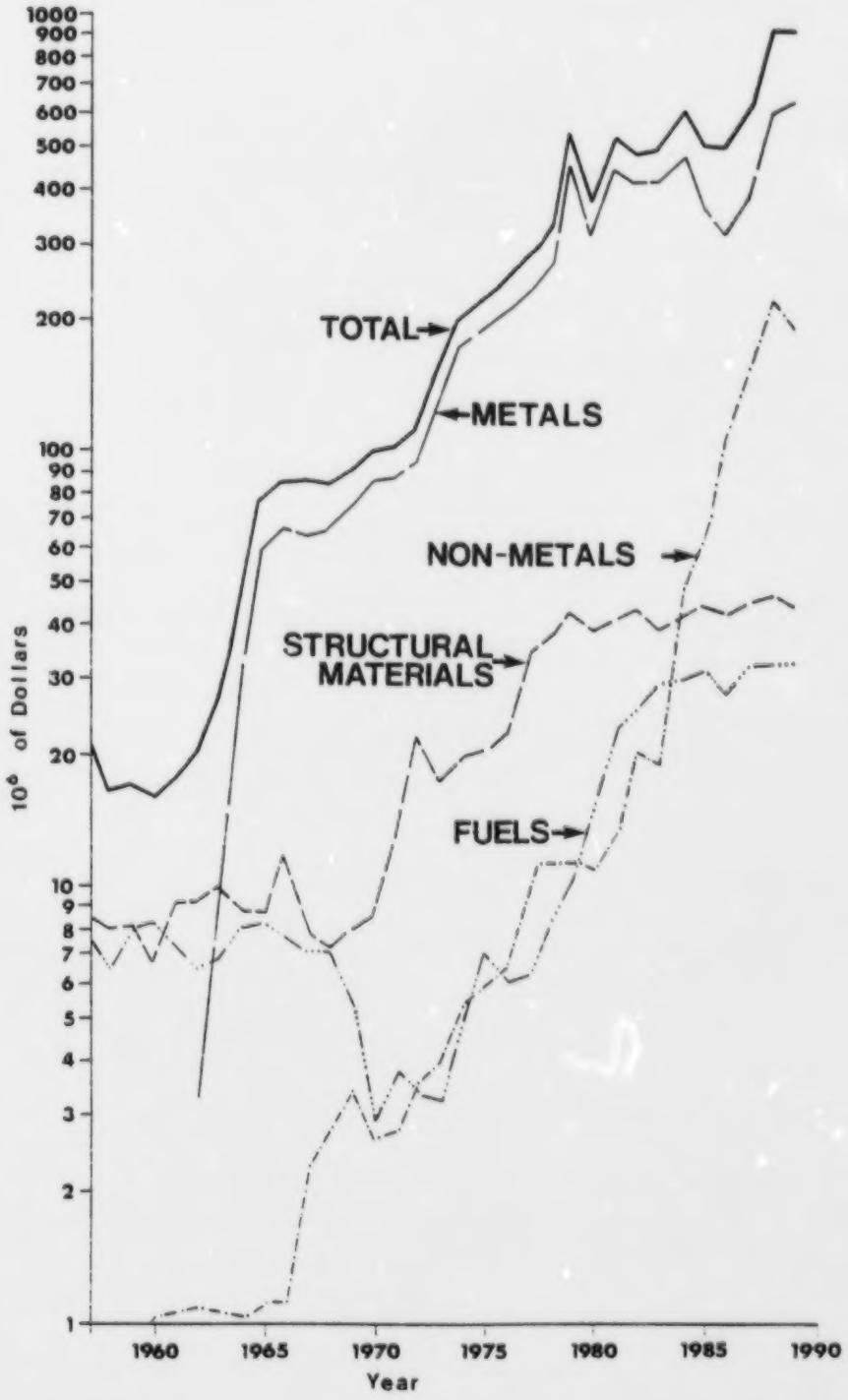

Figure 5. Value of mineral production in New Brunswick, 1957-1989.

by 14% less production to yield a 12% increase in the value of zinc produced.

Lead, the second most valuable metal product to the Province, contributed $71 227 000, a decrease of 6% from the 1988 value. Decreased production (8%) offset by slightly higher average prices brought about this decline. The value of silver production dropped 24% due to both lower production and significantly lower prices. Copper value was up 12% over last year, due mainly to notably higher prices.

Antimony ($5 526 000), bismuth ($2 286 000), cadmium ($666 000, down 45% from last year), and gold ($4 952 000) all contributed significantly to the Province's value of mineral production, even though all were lower than the 1988 values. These losses also can be attributed to reduced output and lower prices.

In the nonmetals sector, potash is the major contributor, but peat and sulphur (from smelter gas) also contribute significantly to New Brunswick's mineral industry.

Nonmetals represent about 21% of the value of mineral production ($194 218 000), a reduction of 14% from 1988. Marginally lower prices and reduced output were the contributing factors.

Value of fuels was $33 800 000, about 4% of the total production. Coal was the major contributor whereas natural gas from the Hillsborough area contributes a relatively small amount.

Structural materials (cement, clay products, lime, sand and gravel, and stone) were valued at $42 005 000 for 1989. These commodities provide the raw material for the construction industry in New Brunswick.

In 1989, New Brunswick ranked first in Canada in the production of antimony and bismuth, second in peat and potash, and third in lead, zinc, and sulphur (from smelter gas).

Metallic Minerals

Brunswick Mining and Smelting Corporation Ltd. mines Canada's largest zinc deposit and operates the world's largest zinc mine (Figure 2, 1). Brunswick celebrated its 25th anniversary in 1989.

The year was expected to be profitable for Brunswick because of elevated prices for zinc, copper, and lead. However, a series of events during the last half of the year precipitated a serious decline in revenue that resulted in a net loss of $4 500 000 for the fourth quarter. The net return for the year was $29 700 000 compared to $31 000 000 for 1988.

Activity in the first half of the year proceeded according to plan, but the second half was marred by severe production problems that were related to modifications to No. 3 shaft, a shortage of backfill, and startup delays at the Heath Steele mine. The production of a lower than normal grade of lead concentrate contributed to the company's decision to conduct a shutdown of the lead smelter in the first quarter of 1990. Because production improved significantly during the latter part of 1989, an anticipated second shutdown of the smelter in 1990 may be shorter than originally expected.

During the last quarter of 1989, changes were made in senior management, and the corporate office in Belledune was eliminated. It is anticipated that the rearrangement of staff will continue into the near future. Employment at the operation remained relatively steady in 1989;

however, some overall reduction is expected in 1990. Management has emphasized that in the future Brunswick will expect each of the company's divisions to be independently profitable.

The current three-year collective agreement with the United Steelworker's Union will end in 1990. In 1989, there was concern among the miners about increased seismic activity in the mine.

Zinc and bulk concentrates continue to be shipped to foreign ports from Brunswick's port facilities in Belledune, also the location of the lead smelter and fertilizer plant. In addition to lead, the smelter produces significant quantities of antimony, bismuth, copper, gold, and silver. Sulphur dioxide smelter gas is used to make sulphuric acid, a key component in the manufacture of diammonium phosphate (DAP) fertilizer that is produced at the adjacent plant.

Reclamation of the No. 6 mine site continued with the removal of structures, revegetation, and the neutralization of acid-generating material by disposal into No. 6 pit. Revegetation was also carried out on the No. 12 property. The generation of thiosalts in the tailings drainage continues to be Brunswick's major environmental concern.

Dominion Explorers Inc. (Durham Mines Division) continued to operate through 1989 as Canada's only primary producer of antimony. However, it was announced that the Durham mine (Figure 1, 12) would shut down permanently on January 19, 1990. The parent company, Dominion Explorers Inc., blamed a number of factors, but paramount was the steady decrease in the price of antimony concentrate, mainly due to an over supply of antimony from both Chinese and Bolivian sources. This, combined with an unfavourable exchange rate for the Canadian dollar and low ore reserves (less than 2 years supply), finally forced the company to make this unfortunate decision.

The mine made a concerted attempt during the year to remain viable by reducing annual operating costs as much as 12%. However, it was not sufficient to offset the decrease in revenue. As a final attempt, the company and the Federal government negotiated a agreement for a work-sharing programme on a reduced-work-week basis (2 days). However, this was not fully implemented because antimony prices continued to drop.

The Federal and Provincial governments have established an industrial adjustment committee to attempt to locate new jobs for the affected miners. Some employment is expected to be found at other mining operations within New Brunswick, especially in the north. At present, the owners hope to salvage as much as possible from the operation and would prefer to have the property purchased intact and used for milling other ores or industrial use.

If no other use can be found for the property, reclamation will commence in accordance with the Mining Act.

East West Caribou Mining Ltd. In December of 1986, East West Minerals, N.L. purchased the mineral rights to the Caribou Resources property (Figure 2, 3) from Anaconda Canada Exploration Ltd. for approximately $1 000 000(US). Work began on the project in the latter part of 1987 and proceeded until the

early part of 1988. At this time expected equity financing from stock market sources did not materialize because of the lack of investor confidence.

Financing for the project was eventually arranged through a five-year limited-recourse debt package of $30 000 000(C), organized through Westpac Banking Corporation and National Australia Bank Ltd., and the Royal Bank of Canada. A further $15 000 000(C) was made available through a silver debenture issue, 50% guaranteed by the Province of New Brunswick (Mining Journal, March 17, 1989). Project development resumed in the second quarter of 1988.

Commissioning of the Caribou mill began in November of 1988 and the first shipment of concentrate (6734 t) left the port of Dalhousie in February, 1989, bound for Australia Mining and Smelting's (AM&S) smelter in Avonmouth, England. The mill exceeded initial design capacity during that period, with higher metal recoveries and mill throughput reaching 2700 t/d, 700 t/d over design. The mine was officially opened on June 2, 1989, by the Hon. Morris Green, Minister of Natural Resources and Energy and Sir William Keys, board chairman of East West Minerals, N.L.

In July of 1989, East West Caribou Mining Ltd. ceased production due to a cash-flow imbalance. The initial result was the layoff of 60 contract miners and the commencement of negotiations with the Province and Australian banks to secure additional financing for the project. In August, it was announced that East West Minerals, N.L. had reached an agreement with Bathurst Base Metals Corp. to implement a revitalization plan for the Caribou mine. Breakwater Resources Ltd. of Vancouver was retained to manage the mine. The permanent workforce was subsequently cut to 40 while revisions to the operation took place.

At present, the company proposes to upgrade the daily mill throughput to 2500 t/d and sink a shaft to facilitate the increased tonnage requirements. Depending upon when final approval of the proposed revisions is obtained from the financiers and government, mining and milling are expected to start in the first quarter of 1990.

Gordex Minerals Ltd. continued to treat ore at its Cape Spencer mine (Figure 1, 13) in 1989. However, no mining was performed during the year. Low gold prices forced the company to discontinue full operation. This resulted in the termination of most of the workforce and operating management. Only a few persons were retained to carry out leaching and waste-water treatment.

A cease-trading order was issued in July, 1989, because of the company's failure to file audited financial statements. Since that time the company has been negotiating with the Ontario Securities Commission to allow resumption of trading on the Toronto Stock Exchange.

Gordex has continued to seek a partner to share in the cost of exploring areas on the property with indicated potential. Drilling in 1988 demonstrated that there was gold mineralization to the north of the area currently being mined. However, the present financial situation appears to be discouraging likely partners from investing in exploration of the zone. The exploration programme expected to be undertaken by Cambior Inc. was

not carried out and the company's option agreement was allowed to lapse. A potential agreement with Societe Miniere Sphinx Inc. (ME) also failed due to low gold prices and Gordex's debt.

Attempts are presently underway to refinance the debt load and make the property more attractive to potential investors. Improvement in the price of gold may help Gordex to obtain financial backing in 1990.

Heath Steele Mines (a division of Brunswick Mining and Smelting Corporation Limited). Brunswick Mining and Smelting and Noranda Exploration Company, Limited share controlling interest in the Heath Steele property (Figure 2, 2). Following an extensive underground exploration programme at the Stratmat site, including bulk sampling and test stoping, Noranda made a decision on February 20, 1989 to proceed with the reopening of the Heath Steele mine. The fact that Heath Steele will be able to share some common facilities with Brunswick was a major factor in the reopening of the mine. Other contributing factors were high base-metal prices and an agreement with Cominco Ltd. to develop the Stratmat property.

The company proposal to open the mine was submitted for screening under the Environmental Impact Assessment Regulation and was screened out on the condition that the proposal receive approval under the Water Quality Regulation and the Mining Act.

The operation is designed to run at a rate of 2200 t/d, with mill feed coming from three zones on the property (Stratmat, B-Zone, and E-Zone).

Production from the Stratmat open pit began in the third quarter of 1989, with some underground extraction taking place as well. The B-Zone has been producing since the second quarter of the year and has supplied ore to Brunswick's mill during the re-roping of Brunswick No. 3 shaft.

Commissioning of the Heath Steele mill is presently underway with full production expected early in 1990. The capacity of the mill prior to its shutdown in 1983 was 3500 t/d.

The company is expected to employ about 220 people during full operation. The total capital investment will be $27 000 000 and annual operating costs will be approximately $27 000 000, including a payroll of $8 400 000.

Feasibility of the project was based on current reserves lasting five years. However, other deposits on the property could extend the life of the operation.

Heath Steele Mines is also in a position to consider custom milling of other local ores to improve profits and extend the life of the operation.

Murray Brook Resources Inc. (a wholly owned subsidiary of NovaGold Resources Inc.). On October 27, 1989, Hon. Frank McKenna officially opened NovaGold's Murray Brook mine.

Financing for the operation was completed following the merger of two companies: Northumberland Mines Ltd. and NovaGold Resources Inc. Initial attempts at acquiring suitable financing by Northumberland had proven ineffective, as did a subsequent equity issue by NovaGold. However, financing was finally put into place in December of 1988 through a limited partnership offering totalling $1 800 000. This, combined with funding already spent on the project, made approximately $4 000 000 of debt financing

available. The debt financing was backed by a loan guarantee from the federally sponsored Atlantic Canada Opportunities Agency (ACOA). The total capital cost to start the mine was estimated to be $6 100 000.

The massive sulphides of the Murray Brook deposit (Figure 2, 4) are capped by gold-bearing gossan that contains approximately 1 540 000 t of ore grading 1.3 g/t gold and 51 g/t silver. The gossan zone is currently being mined, and milling is proceeding at a rate of approximately 1050 t/d. Gold recoveries are greater than 80%. Both milling and recovery rates exceed the original design. The processing facility is one of only three of its type in the world and has features that enhance both its efficiency and environmental integrity. Because it is totally enclosed, ore can be leached on a year-round basis with no characteristic slowdown during the winter months. Enclosure also ensures that airborne or liquid effluent from the operation is strictly controlled.

Gold production is expected to be 466 500 g annually over a five-year period, with silver averaging 7154 kg annually. Thirty employees will be required for the life of the mine.

In addition to the present gold production, NovaGold embarked on an exploratory review of the copper zone beneath the gossan. A drilling programme (more than 1600 m) was conducted in late winter to test the copper zone. Drilling is currently underway to find the southern extension of the base-metal deposit. Initial drilling, performed in advance of the mining in the present open pit, indicated approximately 321 000 t of ore grading 4.68% copper. The feasibility of removing and stockpiling the gossan to enable mining of the copper ore is presently being considered.

In October, the company reported that about 18 000 t of gossan have been processed, from which 1500 t of precipitate were recovered grading 23 712 g/t Au and 180 kg/t Ag. The accumulated lead grade is 1.4 g/t Au and 48 g/t Ag with recovery rates of 87.7% and 19.1%, respectively.

Fuels

Production of coal from the Minto-Chipman area by **N.B. Coal Limited** (Figure 1, 14) decreased marginally in 1989 to 525 000 t. This coal is supplied to the N.B. Power generating facilities at Dalhousie and Grand Lake.

Reclamation work continued on the strip-mined land in the area. In 1989, N.B. Coal Limited reclaimed more land than was stripped.

The environment continues to be a major concern, especially the Fire Road site where acid is produced from iron sulphides in the host rock. Continual treatment with lime is required to neutralize the acid discharge. Extensive hydrogeologic studies have been carried out in the area to better define the problem and preliminary long-term solutions have been reviewed.

Irving Oil Limited continued to produce natural gas from the Stoney Creek oil and gas field (Figure 1, 15). Production in 1989 was 1 005 000 m^3 of natural gas.

Industrial Minerals

Aggregate materials, an important part of the Province's construction industry, is derived

from granular and bedrock deposits. More than 60 companies produce aggregate from numerous pits and quarries throughout the Province.

Most sand and gravel pits in New Brunswick are operated on an intermittent, on-demand basis. Many produce low-specification material. A few companies produce good quality material from large sand and gravel deposits. These are more permanent operations that lie within economical trucking distance of high-demand, urban areas. The pits and processing facilities of **Brunswick Ready-Mix Concrete Ltd.** are 25 km north of Saint John (Figure 1, 16).

Historically, aggregate from bedrock sources has been produced from ten to twelve quarries within the Province. There are large quarries in the Moncton, Saint John, and Fredericton areas with smaller ones in the Campbellton, Havelock, and Elmtree areas.

The New Brunswick limestone industry consists of five producers: **Brookville Manufacturing Company Ltd.** near Saint John (Figure 1, 17), **Lafarge Canada Inc.** and **Havelock Lime** west of Moncton (Figure 1, 18-19), **Elmtree Resources Ltd.** north of Bathurst (Figure 2, 19), and **Upper Kent Lime Works Ltd.** north of Woodstock (Figure 1, 20). These operations produce several hundred thousand tonnes of limestone annually.

Brookville Manufacturing Company Ltd. produces agricultural dolomitic limestone, fertilizer filler, roofing granules, concrete and asphalt aggregate, driveway aggregate, road metal and hardpack road subbase from its quarries at Brookville in East Saint John (Figure 1, 17). Annual production generally exceeds 200 000 t of limestone/dolomite.

Lafarge Canada Inc. operates a quarry several kilometres east of Havelock in Westmorland County (Figure 1, 18). Cement was produced at this location on a regular basis until the early 1980s. After 1982, production of cement from local raw material was limited to fulfilling market requirements for oil well and other specialty cements. The plant was maintained as a grinding operation for imported Nova Scotia clinker until 1987 when the operations were suspended indefinitely. The plant now serves as a distribution point for products from other company operations. The plant's adjacent limestone quarry continues to be operated, supplying raw limestone to Havelock Lime. Aggregate is also supplied to a subsidiary company, Permanent Concrete Ltd.

Havelock Lime (a division of Dickenson Mines Ltd.), at Havelock (Figure 1, 19), produces calcitic agricultural lime, industrial and chemical process stone, and crushed stone for aggregate. Havelock Lime is Atlantic Canada's only producer of calcined and hydrated lime. Annual quarry output and crusher feed generally exceeds 300 000 t. A recently installed Fuller annular-shaft kiln, the first of its kind in North America, has increased the operation's calcining capacity to approximately 300 t/d. Traditionally, the source of supply for the operation has been a quarry at Samphill. In recent years, the high ratio of overburden to limestone at this quarry has limited production. As a result, Havelock Lime has negotiated a long-term agreement with Lafarge Canada Inc. to ensure supply from a nearby quarry.

Elmtree Resources Ltd. operates a quarry and crushing-pulverizing plant about 20 km north

of Bathurst near the Village of Petit Rocher (Figure 2, 19). Annual production exceeds 50 000 t. Limestone is sold primarily to the lead smelter at Belledune as flux and, to a lesser extent, to other customers as aggregate, fertilizer filler, and agricultural limestone. Crushing and pulverizing capacities are sufficient to supply more than four times the current annual demand. Although remaining limestone reserves at a quarry adjacent to the processing facility are limited, two other deposits in the region have recently been evaluated. These have inferred reserves probably sufficient for several decades at current production levels.

Upper Kent Lime Works Ltd. produces marl from the bed of a small drained lake (White Mud Lake) at Maplehurst, Carleton County (Figure 1, 20). Annual marl sales to the region's farmers probably do not exceed a few thousand tonnes.

L.E. Shaw Limited is the Province's major manufacturer of clay and brick shale products. The company established a brick plant at Chipman (Figure 1, 21) in 1929 to utilize waste shale from various coal mining operations in the Minto-Chipman area. The plant now uses shale from a local quarry that was established in 1935. The shale has a highly plastic nature and fires to a hard, dense reliable product, capable of standing the rigours of Canadian winters. In addition to brick, the Chipman plant produces flue liners, and a wide variety of tile products.

Porous shale is used to produce lightweight aggregate, which helps to reduce the weight of concrete used in bridges and high-rise buildings. **Avon Aggregates Ltd.**, a division of Modern Enterprises Ltd., operates a facility in the Minto area (Figure 1, 22).

Dimension stone in the form of various sandstone and granite products have been quarried and fabricated in New Brunswick for many years.

Smith Cut Stone and Quarries Limited, in Westmorland County, has produced an olive-green sandstone and has processed stone from various locations at its Shediac facility (Figure 1, 23) since the early 1800s.

Nelson Monuments Ltd., Sussex (Figure 1, 24), is the largest dimension stone company in the Maritimes. The firm presently owns several granite quarries throughout southern New Brunswick, including Spoon Island, Dawson Mountain, and Digdeguash Lake. They are generally operated on a demand basis. The Spoon Island quarry is the most active. The company uses mainly imported stone to produce monuments. Bases for memorial stones, curbing stone, and many custom-made products are manufactured from domestic stone resources.

Dupuis Cut Stone Ltd. manufactures ornamental and landscape stone products at its facility near Shediac, Westmorland County (Figure 1, 25).

Two companies operate potash mines and associated processing facilities.

Potash Company of America (a division of Rio Algom Ltd.) operates the potash mine and concentrating facility in the Sussex area (Figure 1, 26). The company also operates a potash shipping terminal at Saint John, less than 80 km to the southwest.

In June of 1978, Potash Company of America and the Province of New Brunswick signed a mining lease

covering an area of 19 187 ha.

Mining began in 1983, but at a level much lower than the mine's rated capacity of 380 000 t K_2O annually. Rio Algom Limited purchased the property from Ideal Basic Industries in 1986 and improved production to about 87% of its design capacity in 1988.

A cut-and-fill mining method is employed in the mine, where continuous mining machines are utilized.

Denison-Potacan Potash Company commenced production at its Clover Hill mine (Figure 1, 27) in July of 1985, after about six years of shaft sinking, exploration and construction.

Modified room-and-pillar mining methods employing both continuous mining equipment and drill and blast technology are used to extract ore several hundred metres below surface.

In 1988 the mine achieved production levels near 80% of design capacity (780 000 t K_2O).

Potash from both Sussex area mines is transported to the Port of Saint John. At the port, it is stored in buildings with storage capacity exceeding 100 000 t.

In 1988, **Elmtree Resources Limited** acquired the silica quarry at Bass River, about 7 km east of Bathurst (Figure 1, 28). The company intends to operate the quarry pending market demand.

Sussex Silica Inc. has been operating a quarry near Cassidy Lake since 1986. The deposit, located 22 km southwest of Sussex (Figure 1, 29), consists of unconsolidated quartzose sand and gravel. The material is extracted from an open pit, washed, and screened. The product is marketed for use as smelter flux, silicon metal, silicon carbide, and sand blasting and decorative sand. In 1989 a sample of the sand was tested and proved satisfactory for the manufacture of glass.

Capacity of the Sussex Silica operation is estimated to be 80 000 t annually. There is potential for expansion if market demand warrants.

ACKNOWLEDGEMENTS

The editor wishes to thank all staff members of the Minerals and Energy Division who contributed text and techical expertise toward the preparation of this report. Major contributions of text were made by J.L. Davies, A.A. Ruitenberg, S.R. McCutcheon, Sam McEwan, T.C. Webb, and R. Shaw. Information and statistics were also provided by E.V. Jackson, F.J. Edney, R. Phillips, J.J. Thibault, P.C. O'Leary, and D.J.J. Carroll. Figures were drafted or updated by L.G. Johnson. Kim O'Donnell assisted with typing.

SUMMARY

Base metals and gold continue to dominate mineral exploration in New Brunswick. The Bathurst-Newcastle area, where many base-metal deposits have been found, continues to receive the most attention. Gold exploration was strong in northern and southern New Brunswick. The value of exploration represented by assessment reports was $9 290 145. The number of claims staked in 1989 was 8736, 26% above the 1988 total and the largest number recorded for ten years.

Mining and exploration highlights of 1989 were: (1) the Falconbridge Limited takeover by Noranda Exploration Company Limited and Trelleborg AB; (2) the discovery of a new high-grade sulphide deposit near Brunswick No. 12; (3) the renewed interest in the Mount Pleasant tin-tungsten mine by NovaGold Resources Inc.; (4) the $1 890 000 agreement signed between Mispec Resources Inc. and Hecla Mining Company of Canada Ltd. to explore the Cape Spencer gold properties; and (5) the opening of the Heath Steele-Stratmat, Murray Brook, and Caribou mines.

The value of minerals produced in New Brunswick in 1989 was $909 547 000, which compares quite favorably with 1988's record-breaking $910 803 000.

Overall, metals contributed 70% of the value of minerals produced in the Province during 1989. However, a series of unanticipated events prevented the industry from achieving the potential indicated at the beginning of the year, when base metal prices were their highest in recent years. During the last half of the year, serious production problems at Brunswick's No. 12 base-metal mine resulted in revenues that were significantly lower than expected. Revenue also declined for East West Caribou Mining Ltd., New Brunswick's newest base metal producer. In July, a serious cash-flow imbalance resulted in the temporary shutdown of the operation for the remainder of the year. Production from the revived Heath Steele mine commenced in the latter part of the year. However, the amount of concentrate obtained during this start-up phase was not sufficient to offset shortfalls from the other sources. Because of these situations, 12% less zinc was produced. However, due to elevated prices, the value of production actually increased by 14% over last year. Zinc provides the largest portion of mineral value at 53%. Lead is also a significant contributor (8%) despite an overall decrease in value of 6% from 1988. Excellent copper prices for the year translated into a 12% increase in value to the Province. Cadmium and bismuth are significant by-products of Brunswick's lead smelting operation and their values reflected both a decline in average prices and reduced production. Antimony was one of New Brunswick's base metals whose price did not fair well. With prices plummeting near year's end and the mine showing limited reserves, Dominion Explorers Inc. decided to close the Durham mine, Canada's only primary producer of antimony. Low metal prices contributed to a marked decrease in antimony value from the preceding year. Brunswick Mining and Smelting Corporation Limited also produces antimony as a by-product.

Gold and silver values declined by 25% from last year's levels because of significant price drops from the beginning of the year and from reduced production. The decline in gold production was amplified by the failure of

Gordex Minerals Limited to overcome financial problems and, as a result, the company did not mine in 1989. This was partially offset by the commissioning of New Brunswick's second primary gold/silver producer, Murray Brook Resources Ltd. Production from the Murray Brook mine commenced in the last quarter of 1989 and, in a very short period, has exceeded both expected recoveries and production.

The nonmetals contribution, approximately 21% of the total, is mainly derived from potash mined in the Sussex area. Potash production dropped from the previous year as did its price. These two factors contributed to a decline of 14% in value for this product. Sulphur dioxide, a by-product of Brunswick's lead smelting process, is converted to sulphuric acid and used as a component in making diammonium phosphate at Brunswick's fertilizer plant in Belledune. The value contributed by this commodity was also down this year, again the result of reduced production from Brunswick No. 12 mine.

Peat, a commodity also associated with the argiculture industry, is harvested in northeastern New Brunswick. Peat contributes significantly to nonmetal production in the Province but it too experienced a marginal decrease in production and hence decrease in value to New Brunswick in 1989.

Salt and silica are minor contributors to New Brunswick's nonmetallics industry. Both are produced in the Sussex area. The value of both these commodities varied little from the 1988 figures.

With respect to the value of fuels, N.B. Coal Limited is the major contributor, with a minor amount coming from natural gas production in the Hillsborough area. Coal production dropped marginally from the year before, but still contributed about 4% of the value of New Brunswick's mineral production. Coal production may increase with the proposed development of the Beersville deposits.

Most of the value of structural materials (5%) is generated by sand and gravel and stone, with a minor contribution from clay.

The mineral industry is expected to be at least as successful in 1990 as it was in 1989. Brunswick Mining and Smelting Corporation Limited has initiated steps to prevent the recurrence of the unfortunate events of last year. East West Caribou Mining Ltd. is expected to restart its mine in the first quarter of 1990 at an expanded capacity. Heath Steele Mines has completed its startup phase and full production is underway. Two other small base-metal producers (Marshall Minerals Corp. and Stratabound Minerals Corp.) have plans for mining their orebodies and custom milling their ore this year. Murray Brook Resources Inc. has made application to mine the copper ore that underlies the gold-bearing gossan cap. NovaGold Resources Inc. is currently conducting exploration work on the Mount Pleasant tin deposit, with a feasibility study expected to follow. Gordex Minerals Limited is anticipating a solution to its financial problems and reactivating the Cape Spencer mine. Metal prices are expected to remain relatively stable in 1990 and this, combined with increased production, should result in a prosperous year for New Brunswick's mineral industry.